WOOLLINESS ASSESSMENT IN PEACHES (*CV. SPRINGCREST*) BY SENSORY AND INSTRUMENTAL MEANS

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INTRODUCTION

Mealiness is a negative attribute of sensory texture, characterised by the lack of juiciness without variation of total water content in the tissues. In peaches, mealiness is also known as "woolliness" and "leatheriness". This internal disorder is characterised by the lack of juiciness and flavour. In peaches, it is associated with internal browning near the stone and the incapacity of ripening although there is external ripe appearance. Woolliness is associated with inadequate cold storage and is considered as a physiological disorder that appears in stone fruits when an unbalanced pectolitic enzyme activity during storage occurs (Kailasapathy and Melton, 1992).

Many attempts have been carried out to identify and measure mealiness and woollines in fruits.

The texture of a food product is composed by a wide spectrum of sensory attributes. Consumer defines the texture integrating simultaneously all the sensory attributes. However, an instrument assesses one or several parameters related to a fraction of the texture spectrum (Kramer, 1973).

The complexity of sensory analysis by means of trained panels to assess the quality of some producing processes, supports the attempt to estimate texture characteristics by instrumental means.

Some studies have been carried out comparing sensory and instrumental methods to assess mealiness and woolliness.

The current study is centered on analysis and evaluation of woolliness in peaches and is part of the European project FAIR CT95 0302 "Mealiness in fruits: consumer perception and means for detection".

The main objective of this study was to develop procedures to detect woolly peaches by sensory and by instrumental means, as well as to compare both measuring procedures.

MATERIALS & METHODS

Early soft flesh peaches (Cv. *Springcrest*) from the 1997 season were used for this study. Peaches were grown in Murcia and split in samples within a factorial experimental design.

Duplo samples were stored at the Institute of Soil Science and Biology (CEBAS, CSIC, Murcia) and sent to the Laboratory of Phisical Properties (LPF, UPM, Madrid) and to the Laboratory of Physical and Sensory Properties (IATA, CSIC, Valencia) the night before the measurements were carried out. Isolated boxes with ice bags were used for transportation.

The experimental design was similar at IATA and UPM:

- ripeness stage: three different stages at harvest were selected by production experts, within a set of fruits harvested on the same date in the same orchard. Ripeness segregation was made mainly according to visual references (low, intermediate and high ripeness stage).
- storage temperature: two different storage temperatures were tested under non-controlled atmosphere:+1° and +5°C
- storage period : five different modalities were tested for this factor, at harvest (only at UPM) and weekly for a period of one month.

This design was searched in order to achieve as wide a woolliness range as possible. The number of fruits per sample was 10.

Tests carried out at IATA

- **Sensory analysis:** A panel of 12 trained assessors, evaluated 9 texture attributes. All the assessors had participated in previous experiences generating descriptors and had been trained to detect woolliness in peaches. Intensity of attributes were rated on semiestructured scales (100 mm) anchored on both sides with "weak" and "strong". Descriptive analysis of samples was carried out in duplicate in separate booths, in a standardized test room. Each panelist tastes ¼ of a peach for sample.

* **Chemical analysis:** Soluble solids were detremined in a digital refractometer and expresed as degrees Brix and total acidity by tritation with NaOH and expresed as g/L tartaric acid

* **Instrumental tests:** Penetration force (penetration of fruit flesh with a 8 mm rod, TA-TX2 texturometer).

Tests carried out at UPM

All the measurements were performed on single fruit basis.

* **Sensory analysis by an expert assessor:** each peach was tasted by an expert to identify woolly ones.

* **Chemical analysis:** Soluble solid content by refractomatry and total acidity

* **Instrumental test:**

- Magness-Taylor firmness (penetration of fruit flesh with a 8 mm rod)

- Confined compression: the force deformation ratio was used as *instrumental hardness (N/mm)* and the juice area of the spot accumulated in a filter paper placed underneath the probe during the test,was used as *compression juiciness (mm^2)*

- Shear rupture: the maximum force was used as *instrumental crispness (N)*

RESULTS and DISCUSION

* SENSORY ANALYSIS

From a final list of 23 attributes, 9 texture descriptors were selected to define peach texture: hardness, crispy, juiciness, chewiness, denseness, woolliness, fibrousness, granularity and pulpy.

With an analysis of variance (ANOVA), the effects of the experimental factors (time of storage, temperature of storage and ripeness stage at harvest) were studied. Hardness and crispness presented significant differences for all the experimental factors, especially with the temperature of storage. However, juiciness did not present significant differences with storage temperature. All the experimental

factors had significant differences with the attribute woolliness, but the ripeness stage at harvest effect was less important.

On the other hand, the evolution of some attributes along the storage time was also studied. The peaches maintained their sensory hardness when they were stored at 1ºC. However, when they were stored at 5ºC the sensory hardness decayed from 6.5 to 2. Sensory crispness followed the same pattern as sensory hardness. At 1ºC this attribute remained around 7, but at 5ºC sensory crispness decayed from 6 to 2 . Once more, sensory woolliness followed a similar pattern, at 1ºC sensory woolliness remained constant during the period of storage while at 5ºC it stated increasing after 2 weeks of storage with a constant gradient (from 1 to near 6) (figure 1).

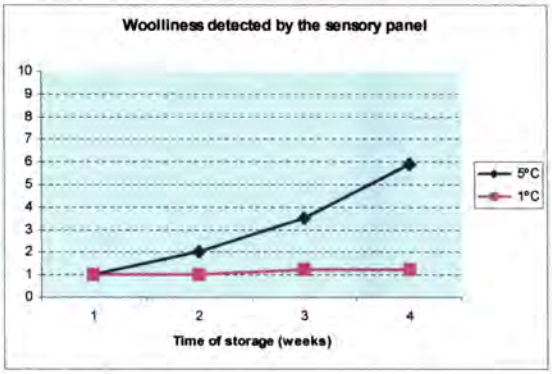

Figure 1. Woolliness evolution during storage (at 1ºC and 5ºC) measured as the intensity of the attribute detected by the sensory panel in a 0-10 scale (cv. *Springcrest*)

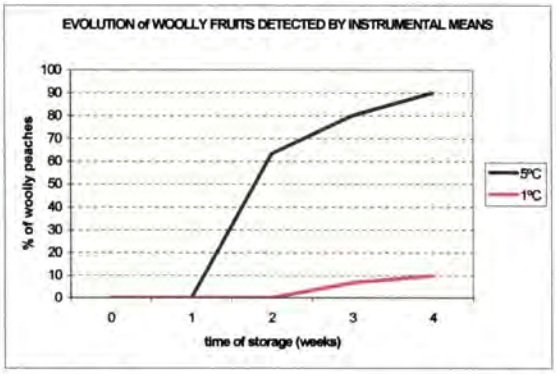

Figure 2. Instrumental woolliness evolution during storage (1ºC and 5ºC) according to the instrumental procedure measured as the percentage of woolly fruits (cv. *Springcrest*)

* INSTRUMENTAL ANALYSIS

Based on the sensory profiling of woolly peaches carried out by the IATA and previous results obtained working in apples by UPM 3 descriptors were selected to be assessed by instrumental means: crispness, hardness and juiciness.

The instrumental variables: instrumental crispness (N), instrumental hardness (N/mm) and instrumental juiciness (mm^2), related to the 3 selected sensory attributes were gathered together with Magness-Taylor firmnes (N) to identify woolly peaches based on a non supervised classification technique. The classification procedure consists of an initial grouping into: 1) crispy, firm and hard fruits (CH) and 2) non crispy, non firm and soft fruits (S) according to the instrumental crispness (N), the Magness-Taylor firmness (N) and the instrumental hardness (N7mm). At a second stage, soft fruits (S) are segregated into 3 juiciness categories according to their instrumental juiciness (mm^2): high (HJ), medium (MJ) and low (LJ). Non crispy, non firm and soft fruits with low juiciness are identified as woolly fruits. This procedure detected woolly peaches after 2 weeks of storage at 5ºC (Figure 2).

The identification of individual woolly peaches was compared to the individual sensory identification of an expert. The detection carried out by the instrumental procedure was similar to the detection of the expert assessor, woolly peaches were detected in those samples stored at 5ºC for 2 weeks (Figure 3).

There were slight differences in the number of woolly fruits detected after 2 weeks under 5°C storage by the instrumental procedure when compared to the sensory expert. For longer storage periods (3-4 weeks) the number of woolly fruit detected by the instrumental procedure and by the sensory expert was nearly the same.

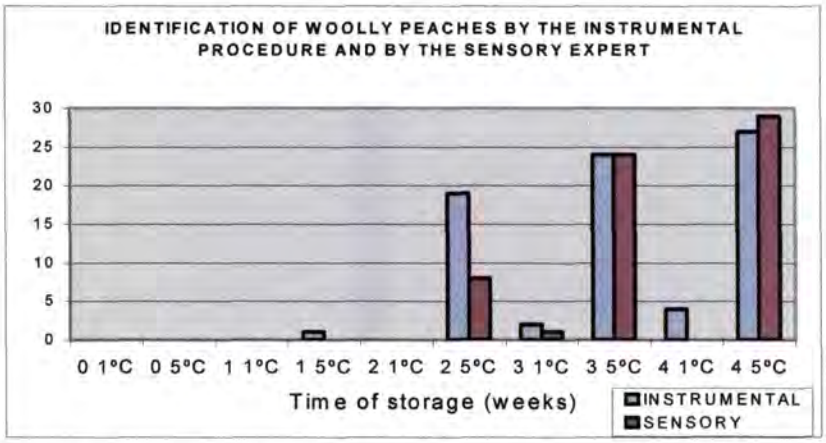

Figure 3. Identification of woolly peaches by the instrumental procedure and by the expert sensory assessor

* COMPARISON BETWEEN SENSORY AND INSTRUMENTAL DATA

There are some important differences in the way of evaluating woolliness by the sensory panel and by the instrumental procedure. The sensory panel assessment of woolliness (Figure 1) is given in a 0-10 scale (intensity of the attribute detected by the panel) while the instrumental measurement (Figure 2) assesses the woolliness stage of a batch of fruits as the percentage of woolly fruits. Besides those basic differences the pattern of woolliness onset detected by both procedures was similar. At 1°C the sensory level of woolliness was around 1 over 10; this was similar to the instrumental results: almost no peach was identified as woolly by instrumental means at 1°C.

According to the sensory panel, woolliness starts after 2 weeks of 5°C storage (at these experimental conditions), with an intensity of 2 over 10 in the sensory scale. This result is lower when compared to the instrumental result: 63% of peaches were classified as woolly. After 3 weeks, woolliness assessed by the sensory panel showed an increase reaching a maximum of 6 over 10 after 4 weeks of storage. These results are much more comparable to the instrumental percentages of 80% and 90% of woolly peaches at 3 and 4 weeks of 5°C storage.

Therefore, it can be concluded that the sensory panel and the instrumental procedure applied to paralell samples of peaches were able to assess woolliness with a similar pattern. Maximum agreement is found at initial and final stages of woolliness development.

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